

A Randomized Controlled Trial Comparing Internet and Video to Facilitate Patient Education for Men Considering the Prostate Specific Antigen Test

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BACKGROUND: Little is known about the relative advantages of video versus internet-based decision aids to facilitate shared medical decision making. This study compared internet and video patient education modalities for men considering the prostate specific antigen (PSA) test.

METHODS: Two hundred and twenty-six men, aged 50 years or older, and scheduled to complete a physical examination at an HMO Health Appraisal Clinic were randomly assigned to access a website ($N = 114$) or view a 23-minute videotape in the clinic ($N = 112$) prior to deciding whether they wanted to be screened for prostate cancer.

RESULTS: There were no between-groups differences in participants' ratings of convenience, effort, or satisfaction following exposure to the decision aid. Participants assigned to the video group were more likely to review the materials than individuals assigned to the internet group (98.2% vs 53.5%). Participants in the video group showed significantly greater increases in PSA knowledge and were more likely to decline the PSA test than individuals assigned to the internet group. However, participants in the internet group who reviewed the entire online presentation showed similar increases in PSA knowledge as video participants. Only 5% of all participants visited other websites to inform themselves about the PSA test.

CONCLUSIONS: Overall, the video was significantly more effective than the Internet in educating participants about benefits and risks of PSA screening.

KEYWORDS: patient education; decision aids; prostate specific antigen; Internet.

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Decision aids provide patients with information about options available in a medical decision and can be used to facilitate shared decision making with a healthcare provider. The probable implications of preventive screening and treatment choices are often presented with interactive

videodisc, videotape, decision boards, scripted consultations, or most recently, the Internet.^{1,2} Randomized, controlled trials suggest that decision aids increase patient knowledge, subjective reports of feeling informed, and the likelihood of declining aggressive treatment. Decision aids increase patients' preference for participation in medical decision making.³

There is substantial controversy surrounding the use of the prostate specific antigen (PSA) test to screen for prostate cancer.⁴ The source of the controversy is the lack of conclusive evidence showing reductions in prostate cancer mortality as a result of using the PSA test. Because of the uncertainty surrounding the value of PSA screening, patients need assistance to reach an individualized decision. To date, the PSA decision is the best-studied issue in the evaluation of decision aids.⁵ The majority of studies found significant increases in knowledge about the PSA test among participants, as well as reduced screening rates using the PSA test, compared with control conditions.⁵

The purpose of the present study was to compare the clinical effectiveness of an internet-based decision aid with a video for educating men about issues relevant to PSA screening. We postulated the following *a priori* hypotheses:

1. Participants assigned to the internet group would rate the intervention as more convenient, more satisfying, and requiring less effort than participants assigned to the video group. They would therefore be more likely to review the educational materials than participants assigned to the video group.
2. Participants assigned to the internet group would show greater increases in PSA knowledge from pre- to posttest than participants in the video group.
3. Participants in the internet group would request significantly fewer PSA tests at posttest than participants in the video group.

METHODS

Design

The study utilized a pre- and posttest 2-group design. Patients were randomly assigned to: (1) view a video describing the information relevant for making an informed decision about the PSA test, or (2) to access a website containing the same information as the video, adapted to the Internet.

Participants and Procedure

Participants were recruited from the Health Appraisal Clinic (HAC) of the Department of Preventive Medicine at

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Kaiser Permanente, San Diego. The clinic conducts preventive screening examinations and has been described in detail elsewhere.^{6,7}

Any man over the age of 50 years who made an appointment at the HAC was sent a letter informing him of the availability of the PSA test as part of the health appraisal and a description of the study. All men were provided with a unique arbitrary ID and password, allowing them to access a secure internet site containing all study materials. Participation required having personal Internet access at home or work. Internet access was not provided to participants as part of the study.

Once a potential participant accessed the website, he found a brief description of the study reiterating the content of the letter from HAC. Following login, the man was connected to a secure site where the informed consent document was presented. The remainder of the website was also secure. Participants indicated their agreement to participate by clicking a tab at the bottom of the informed consent page and then completed the preassessment. Once the questionnaire was completed, the server automatically assigned the participant to 1 of the 2 groups based on a sequence previously generated with a random number generator. Participants assigned to the Internet group were given unlimited access to the site until the time and day of their appointment at the HAC. Participants assigned to the video group were informed that they could view the video at HAC 30 minutes prior to their appointment. All participants were provided a telephone number to call in case of procedural questions. Participants assigned to the internet group were unable to view the video without this being known to the investigators. Similarly, participants in the video group were unable to review the internet presentation.

Measures

All participants completed study questionnaires on the study website. At baseline they provided demographic information including age, marital status, education, ethnicity, history of personal, familial, and friends' cancer diagnosis, and number of previous PSA tests. The study used 3 primary outcome measures: (1) participant ratings of convenience, effort required, and satisfaction with the intervention assessed at posttest with 5-point Likert-type scales; (2) knowledge about prostate cancer screening and treatment assessed at pre- and posttest using a questionnaire used in 2 previous studies^{7,8}; and (3) choice of PSA test queried with a Yes/No question at pre- and posttest and verified with medical records at posttest. Posttest assessment also included participants' ratings of the amount and clarity of the information provided, length of the respective presentations, how balanced and fair the presentations were, and how they generally felt about receiving information in the format in which it was presented. All participants were asked how many other websites they visited for information about the PSA test. For participants assigned to the Internet group, the server hosting the study

website recorded the number of times they accessed the website and how much of the online presentation they reviewed during each visit. A previous study found that patients were more likely to indicate a preference for watchful waiting as treatment for prostate cancer following exposure to a PSA decision aid.⁷ The present study also queried participants' prostate cancer treatment preferences at pre- and posttest. Participants were asked to indicate whether they would choose surgery, radiation, or watchful waiting as treatment, if diagnosed with prostate cancer.

Video and Internet Presentation

The video and the website were developed by Health Dialog in collaboration with the Foundation for Informed Medical Decision Making. The 23-minute video was previously evaluated in several studies.⁷⁻¹⁰ The Internet presentation for facilitating PSA shared decision making has not previously been evaluated, and sought to mirror as closely as possible the content of the videotape. In order to accommodate internet users with slower dial-up connections the internet presentation did not use video but rather presented 47 slides using images, graphics, and audio content taken from the video with Flash player software (Macromedia, Inc., San Francisco, CA). As a result, the internet presentation was slightly less time efficient than viewing the video. Reviewing the online presentation without pause required 25 to 30 minutes, depending on modem speed. During initial review of the presentation, participants had to view each slide in a linear successive fashion. Following the initial review, participants were able to skip slides forward and backward.

Protection of Human Subjects

The protocol and informed consent were reviewed and approved by 4 separate institutional review boards: the University of California, San Diego, San Diego State University, Kaiser Permanente, and Friends Research Institute.

Statistical Analysis

The purpose of this study was to evaluate the clinical effectiveness of the interventions in educating men about issues relevant to PSA screening. In examining participants' PSA knowledge, we therefore used an *Intention-to-Treat* analytic approach, in which all participants are included in the analyses, regardless of whether or not they received the intervention. Changes in PSA knowledge were analyzed with Greenhouse-Geyser-corrected multivariate repeated measures analysis of variance. The number of previous PSA tests was included as the covariate. Type I error was controlled in simple effects tests using Bonferroni corrections. Effects of the interventions on the rate of PSA testing were examined using stepwise hierarchical logistic regression. Confounding demographic variables were entered first as covariates in the logistic regression models. Next, pretest PSA test choices were entered in the analysis followed by

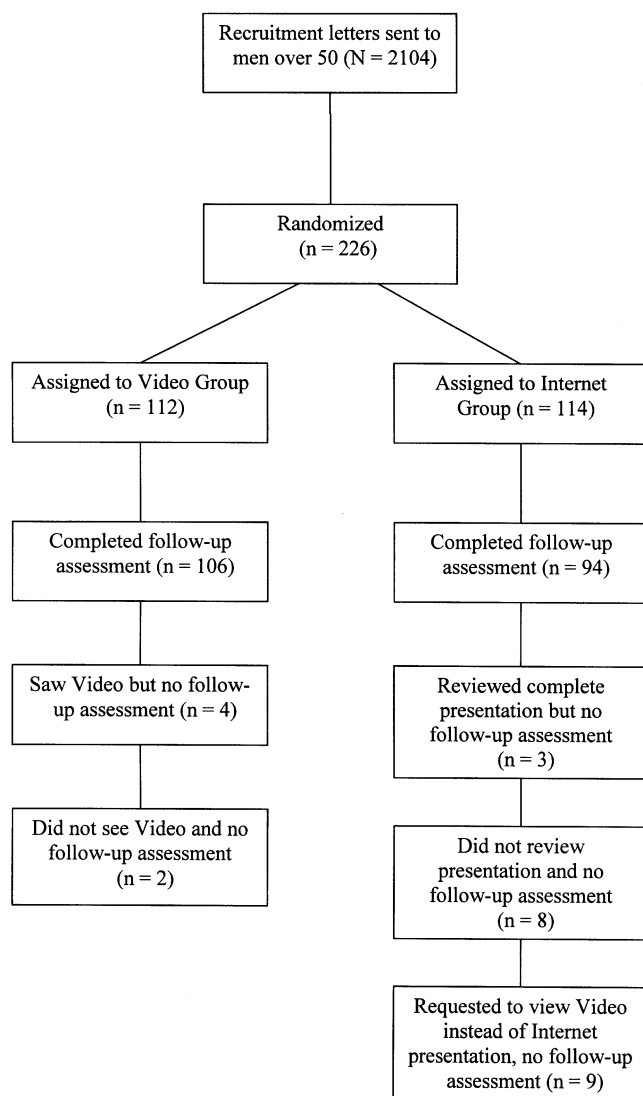


FIGURE 1. Participant recruitment and randomization flowchart.

the group assignment variable. We report changes in χ^2 tests for each step of the analysis and final model statistics. Rates of review of the educational materials in the 2 groups were also compared with logistic regression. Confounding demographic variables were entered in the first step followed by the group assignment variable. The presence of a significant interaction effect in logistic regression or analysis of variance analyses indicates that an independent variable has differential effects at different levels of another independent variable. Categorical variables with more than 2 levels were analyzed with Pearson χ^2 tests.

RESULTS

Figure 1 illustrates the flow of participants and completion of follow-up assessments. Participants were recruited between March 28 and August 31, 2001.

Prior to evaluating the main hypotheses of the study, baseline characteristics of participants assigned to the video and internet groups were compared. There were no

statistically significant differences for any of the comparisons. Baseline characteristics by intervention group are listed in Table 1.

Baseline characteristics of participants who completed all follow-up measures ($N = 200$) were compared with those that did not complete follow up ($N = 26$). The only difference was that participants who did not complete follow up were significantly less likely to be married or living as married (68.4%) than participants who completed all assessments [88.4%; $\chi^2 (1) = 6.04, P < .05$].

There were no differences in the ratings of the PSA presentations, ratings of convenience, effort required, satisfaction with the presentations, and overall sentiments about participating in these types of interventions. The majority of participants rated the amount of information as "About right" (78.9%), clarity of the information as "Good" or better (94.0%), length of the presentations as "About right" (78.4%), and balance of the presentations as "Completely balanced" (70.9%). The majority of participants rated viewing the presentations as "Somewhat" or "Very convenient" (67.3%), indicating that reviewing the presentations required "No more" or "A little more" effort (80.8%), and expressed being "Considerably" or "Very Satisfied" with having viewed the presentations (75.2%). Overall, 80.9% of participants felt "Somewhat" or "Very positive" about participating in these interventions.

Contrary to the a priori hypothesis, participants assigned to the video group were significantly more likely to review the educational materials than participants assigned to the internet group [$\chi^2 (1) = 73.29, P < .001$]. Among participants assigned to the video group, 110 (98.2%) came to the clinic 30 minutes prior to their actual appointments, in time to review the video. Only 61 (53.5%) of those assigned to the internet group reviewed the entire presentation. Forty-five internet participants (39.5%) never reviewed any part of the presentation. The range of number of slides reviewed by those not completing the presentation was 1 to 29 (mean = 9.38, SD = 11.38).

Of those assigned to the internet group, 24.7% had to download additional software in order to review the presentation. However, there were no differences in downloading software comparing those who reviewed the complete presentation with those who did not.

Consistent with an Intention-to-Treat analytic approach, data for the PSA knowledge variable were imputed differentially for those participants who did not complete follow-up assessments. For participants who reviewed the complete materials we substituted the mean of the corresponding group. For participants who did not review the materials, as well as Internet participants who requested to view the video, pretest responses were carried forward.

In order to examine the effect of our imputations, we also report this analysis using uniformly imputed data, in which missing data are replaced by pretest scores, as well as an analysis using complete cases only. The differences in covariate adjusted means between these 3 ways of

Table 1. Baseline Comparison of Intervention Groups

	Video (N = 112)	Internet (N = 114)	Statistic
Mean age, (SD)	61.85 (8.26)	62.25 (9.31)	t (224) = -0.34, NS
Ethnicity, %			
African American	0.0	0.9	χ^2 (5) = 6.29, NS
Hispanic	3.6	3.5	
Asian/Pacific Islander	5.3	1.8	
Native American	1.8	0.0	
Caucasian	88.4	93.8	
Other	0.9	0.0	
Marital status, %			
Never married	3.6	2.6	χ^2 (5) = 1.63, NS
Married	83.8	83.3	
Separated	1.8	1.8	
Widowed	3.6	1.8	
Divorced	4.5	7.0	
Living as married	2.7	3.5	
Education, %			
High school	9.8	5.3	χ^2 (4) = 4.86, NS
Some college	23.2	30.6	
College graduate	27.7	28.1	
Some graduate school	8.9	13.2	
Completed postgraduate	30.4	22.8	
History of cancer (self),* %	15.2	12.3	χ^2 (1) = 0.40, NS
History of cancer (family),* %	69.6	71.9	χ^2 (1) = 0.14, NS
History of cancer (friends),* %	77.7	75.4	χ^2 (1) = 0.16, NS
Concern about prostate cancer, %			
Not at all	10.7	8.8	χ^2 (4) = 4.62, NS
A little	35.8	30.7	
Somewhat	23.2	33.3	
Considerably	22.3	15.8	
Extremely	8.0	11.4	
Number of previous PSA tests, mean (SD)	2.09 (3.15)	2.29 (2.80)	t (221) = -0.51, NS
Pretest choice of PSA,* %	99.1	100.0	χ^2 (1) = 1.02, NS
Pretest confidence in decision (0–10), mean (SD)	9.09 (1.64)	9.32 (1.33)	t (224) = -1.14, NS
Pretest PSA knowledge (0–5), mean (SD)	1.91 (1.02)	1.86 (1.01)	t (224) = 0.38, NS
Who should make medical decisions, %			
Doctor only	2.7	5.3	χ^2 (4) = 4.59, NS
Mostly the doctor	8.9	13.2	
Both	79.4	72.7	
Mostly you	5.4	7.9	
You only	3.6	0.9	

* Endorsing "Yes"; PSA, prostate specific antigen.

analyzing the data are shown in Table 2. Since the interpretation of the analysis did not differ depending on whether or how data were imputed, we focused our report on the analysis of differentially imputed data.

We found an overall increase in PSA knowledge from pre- to posttest ($F_{1,220} = 159.99$, $P < .001$). There was a significant interaction effect of group by assessment time point (pre or posttest) ($F_{1,220} = 16.24$, $P < .001$). Simple effects tests showed a greater increase in PSA knowledge in the video group ($t_{(221)} = 4.07$, $P < .001$). Owing to missing covariate data for 3 participants, these analyses reflect a sample size of 223 instead of 226.

In addition to the group by assessment time point interaction, there was also a significant interaction of the covariate (previous PSA tests) by assessment time point ($F_{1,220} = 6.28$, $P < .02$). As shown by the bivariate correlation between previous PSA tests and PSA knowledge

change from pre- to posttest ($r = -.17$, $P < .05$), individuals who had more previous PSA tests learned less from exposure to the educational materials.

Closer examination of participants assigned to the Internet group showed that individuals who completed the review of the presentation experienced greater increases in PSA knowledge than those who did not ($F_{1,112} = 22.83$, $P < .001$). Moreover, there were no differences in PSA knowledge changes from pre- to posttest comparing Video participants with Internet participants who reviewed the entire online presentation. Figure 2 illustrates PSA knowledge changes for the video group, the internet group, and internet participants who completed the review of the educational materials.

At pretest, 218 participants (99.5%) indicated that they would want a PSA test as part of their physical examination. Logistic regression analysis showed a significant overall

Table 2. Analysis of Changes in Prostate Specific Antigen Knowledge

	Pretest			Posttest			Statistic*
	Mean	SE	95% CI	Mean	SE	95% CI	
Differential imputation							$F_{1,220} = 16.24, P < .001$
Internet	1.86	0.10	1.67 to 2.05	2.70	0.11	2.48 to 2.93	
Video	1.91	0.10	1.72 to 2.09	3.44	0.12	3.21 to 3.66	
Uniform imputation							$F_{1,220} = 12.82, P < .001$
Internet	1.86	0.10	1.67 to 2.05	2.73	0.12	2.49 to 2.96	
Video	1.91	0.10	1.72 to 2.09	3.37	0.12	3.14 to 3.61	
Complete cases only							$F_{1,194} = 7.22, P < .009$
Internet	1.84	0.10	1.64 to 2.04	2.90	0.12	2.65 to 3.14	
Video	1.92	0.09	1.74 to 2.11	3.47	0.12	3.24 to 3.70	

* Statistic is for the interaction of group by assessment timepoint; SE, standard error; CI, confidence interval.

decline in the number of PSA tests requested at posttest with 190 (86.8%) participants requesting the test [$\Delta\chi^2$ (1) = 4.07, $P < .05$]. Controlling for pretest choice, there was a significant effect of group [$\Delta\chi^2$ (1) = 4.61, $P < .05$], with individuals in the video group (81.5%) requesting significantly fewer PSA tests than those in the internet group (91.9%). The final model was statistically significant [χ^2 (2) = 8.68, $P < .05$; 87.2% classified correctly].

There were no pretest differences in the hypothetical choice of treatment indicated if prostate cancer were diagnosed. Overall, 31.9% of participants indicated they would choose radical prostatectomy surgery, 31.4% indicated they would choose radiation treatment, and 36.7% indicated they would choose watchful waiting. There was a significant overall shift in treatment preferences from pre- to posttest, with 64.8% indicating that they would choose watchful waiting at posttest [χ^2 (4) = 103.87, $P < .001$]. Logistic regression analysis showed that after controlling for pretest choices, individuals assigned to the video group were more likely to endorse watchful waiting (76.8%) than those assigned to the internet group [53.2%; χ^2 (2) = 57.91, $P < .001$].

Closer examination of posttest choices among participants assigned to the internet group revealed that

participants who reviewed the complete online presentation were significantly more likely to endorse watchful waiting than those who did not review the entire online presentation [χ^2 (2) = 15.08, $P < .001$]. These differences are illustrated in Figure 3.

Five percent of participants visited other internet sites to inform themselves about the PSA test. There were no differences between intervention groups in the rate of visiting other websites (internet = 3.2%, video = 6.6%, NS). There were also no differences in visiting additional websites comparing those individuals assigned to the Internet group who viewed the complete presentation with those who did not view the entire presentation.

Since our results did not support our a priori hypotheses, we conducted posthoc analyses in an attempt to identify variables that could predict whether or not Internet group participants reviewed the educational materials. To reduce the possibility of Type I error, we applied a more conservative alpha level of 0.01 in these analyses. We compared Internet participants who completed the review ($n = 61$) of the educational materials with those who did not ($n = 53$) on a range of baseline variables. The only difference we identified was that participants who completed the review of the materials were more likely to have a family member

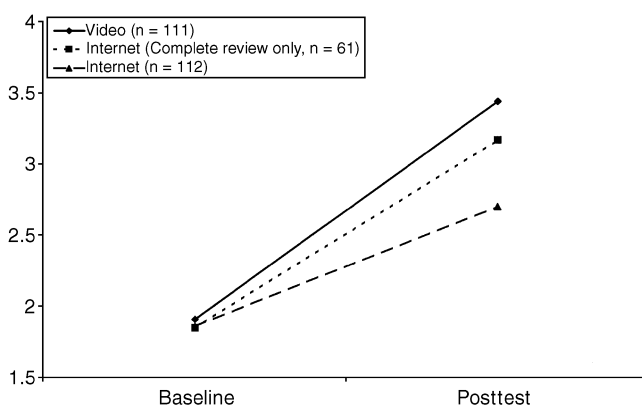


FIGURE 2. Changes in prostate specific antigen knowledge.

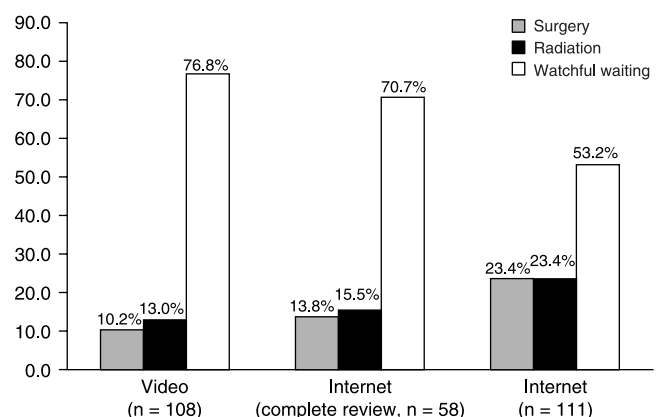


FIGURE 3. Hypothetical prostate cancer treatment choices.

or friend who had been diagnosed with prostate cancer [60.7% vs 34.0%; $\chi^2(1) = 8.09$, $P < .01$].

DISCUSSION

An increasing number of patients use the Internet to seek health information independent of their physicians' recommendations.¹¹ Nonetheless, few studies have formally evaluated the effectiveness of internet-based patient education and compared this with other methods of providing healthcare information. The present study is one of the first that directly compares two different methods of educating patients about issues involved in a clinical decision. Decision aids such as these are frequently used to facilitate shared decision making between physicians and patients.

Contrary to our expectations, the internet and video were rated equivalent in effort required, perceived convenience, and patient satisfaction. We hypothesized that participants who could access the PSA information from home over the internet would be more likely to review it. Instead, participants assigned to view the video 30 minutes prior to their clinical appointments were much more likely to review all of the information provided. As a result, the video was more effective than the internet in educating participants about relevant issues, and consistent with previous reports, participants in the video group were more likely to decline the PSA test.⁵ Similar to previous studies, participants who reviewed the educational information were more likely to indicate a preference for watchful waiting.

Other than being more likely to have a family member or friend that had been previously diagnosed with prostate cancer, we were unable to identify demographic characteristics that predicted complete review of the internet information. Failure to review the online presentation was not associated with having to download additional software. While knowing someone previously diagnosed with prostate cancer may have led to heightened interest in PSA screening, we suspect that participants who did not review information provided online became distracted by other activities and simply forgot to return to the website prior to their appointments. By contrast, participants who were assigned to view the video in the clinic 30 minutes prior to their appointment did not view this as a significant inconvenience. As a result, almost all video participants arrived in the clinic early and became a captive audience for the videotape.

Although the internet clearly proved to be less effective in this study, our results suggest important future research questions. For those participants assigned to the internet who reviewed all of the information provided, increases in PSA knowledge were similar to those observed in the video group. In the present study, we did not monitor whether internet participants had reviewed the information as their appointments approached. Future studies should examine if the effectiveness of providing health information online can be improved by reminding patients to review the

information by e-mail, or possibly by automated phone reminders.

Interestingly, failure to review the online presentation in this study did not lead to attempts to obtain information on the PSA test from other websites. Among the three individuals assigned to the internet group who accessed other websites, all reviewed the entire study presentation. Overall, very few participants accessed other internet sites to find information about PSA screening. Previous reports have found that individuals are concerned about the accuracy of information on publicly available websites, and that their healthcare providers are generally viewed as the trustworthiest sources of information.^{12,13} The present study suggests that once guided to a sanctioned source of information, individuals are unlikely to seek additional information elsewhere.

Limitations and Future Directions

This study has several limitations. First, it involved participants from a single clinic with a unique focus on preventive health evaluations. This population may not be representative of a typical primary care population. The majority of participants were white, with a relatively high level of education. A previous HAC internal survey found that approximately 50% of patients have internet access. Hence, our recruitment approach yielded a relatively low rate of participation of 21.5%, potentially limiting the generalizability of our findings.

It could be argued that our differential data imputations introduced bias into the findings by reinforcing central tendency. However, alternate imputations yielded findings that were almost identical.

The precise reasons why participants assigned to the internet group did not review the online presentation are not known. Future research should make a more careful assessment of technical factors involved in the use of internet decision aids. Although our results suggest that the internet presentation was similar in content to the video when reviewed in its entirety, we should have ideally pretested the content of the presentation for equivalence with the video prior to beginning this study.

Another potential limitation of the study is that the 2 modes of intervention may not have been equivalent in their demands on participants. In order to review the materials, participants assigned to the internet group had to allocate time at home or work, prior to their appointments. On the other hand, participants assigned to the video group also had to allocate additional time to review the materials, but at a specific prescribed time. Nearly all video participants (98.2%) came to the clinic 30 minutes early. The additional amount of time required to review the materials was similar in both groups, with the difference being that internet participants had greater flexibility over when to allocate this time. Although we cannot be certain, we do not believe that these differences significantly confounded our results. Rather, our study illustrates some of the possible pitfalls

of relying on patients to review important medical information outside of the clinic. The effect of assigned versus self-allocated time upon patient choice should be investigated in future research.

The present study suggests several additional questions for future research. For their first review of the online presentation, Internet participants were forced to review the presentation in a linear step-by-step fashion. It is unclear whether there would have been differences in the number of participants reviewing the information if they could have chosen freely which parts of the presentation to review and when. The online presentation in the present study did not incorporate video or interactive components. One recent study does suggest that interactive components have significant potential.² Although internet participants generally indicated that the length of the presentation was "About right," it is unclear whether a shorter presentation would have led to greater uptake of the information. The internet offers a unique opportunity to examine the effects of offering varying amounts of detail on patients' learning and decision making.

The results from this study highlight a crucial difference between conducting patient education in the clinic and relying on patients to acquire the same information by using a sanctioned internet source. Health care providers have significantly more control over what information can be provided to patients when education occurs in the clinic. Our findings suggest that simply providing access to an internet-based decision aid is not as effective as showing a video in the clinic.

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